Basic Electronics: *Practical Circuits*

Prepared by:
WD8PU

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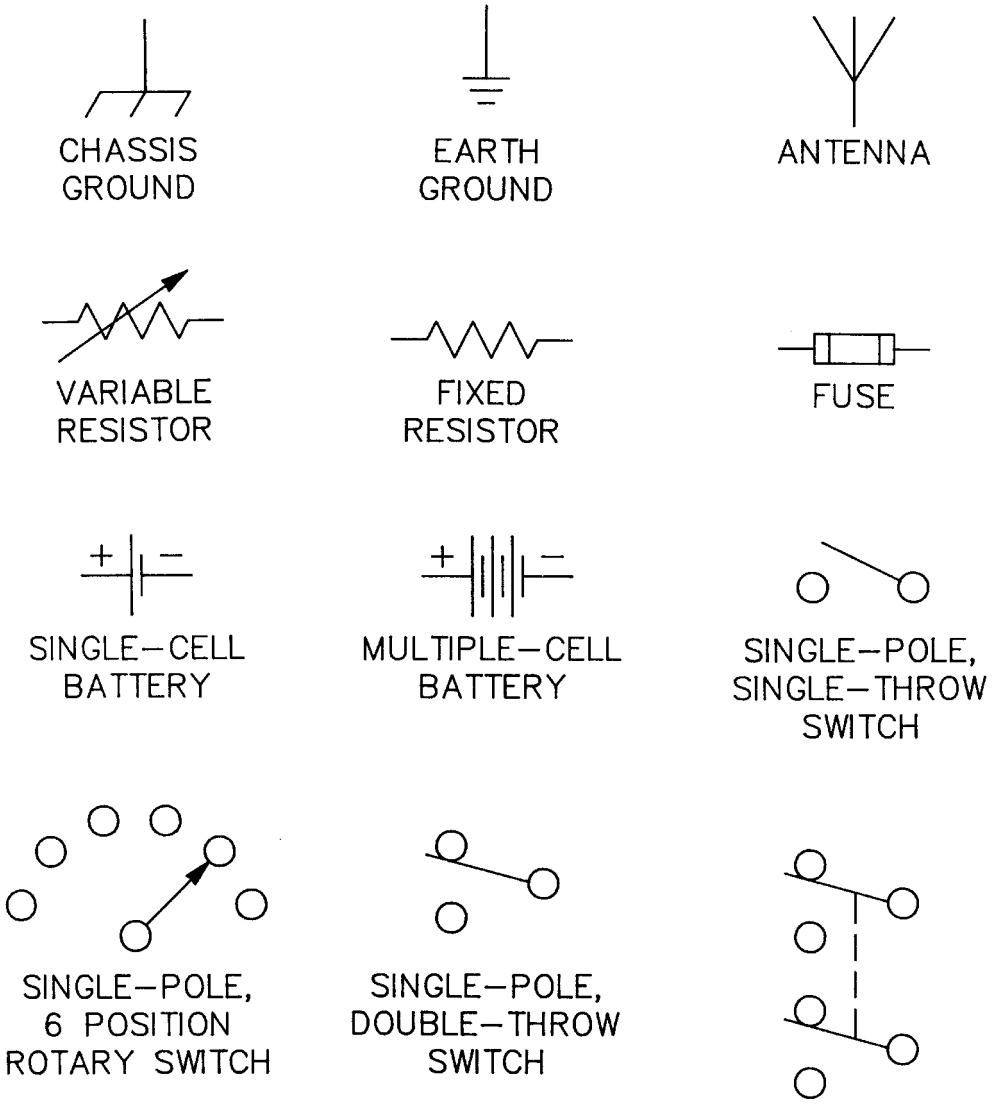
Schematics

Beyond knowing these schematic images, the amateur must also know that a good conductor is metals such as...

- Copper
- Gold
- Silver
- Aluminum

An insulator of electricity is non metallic...

- Glass
- Air



NOTE: an “Open Circuit” can have no current, a “Short Circuit” has too much

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Grounding…

- All chassis grounds in RF equipment ought to be earth grounded by means of a “daisy chain” connection of equipment to a single earth ground.
- The earth ground ought to be a 8’ copper rod in the ground as an absolute minimum…underground wire radials emanating from the copper ground rod will help considerably.
- Never use multiple grounds. A good ground will reduce atmospheric noise into your receiver, and improve transmitter performance.
- When antennas are not in use, always ground both coax conductors. During thunder storms, disconnect the ground, power cords, and all antenna connections from your equipment. Even a close lightning strike can destroy your solid state radios.
- Poor equipment grounding can increase the likelihood that your station will cause Radio Frequency Interference (TVI) (RFI).
- A poor equipment ground can result in electrical shock and even RF burns.
- The “green-wire” in a three-wire AC line cord power supply ought to be connected to the chassis ground.
- Grounding helps minimize “audio rectification” (by

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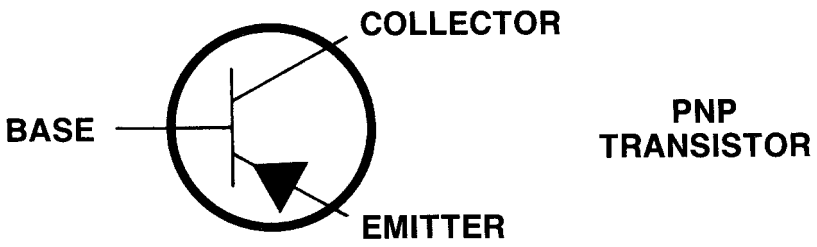
Schematic S...

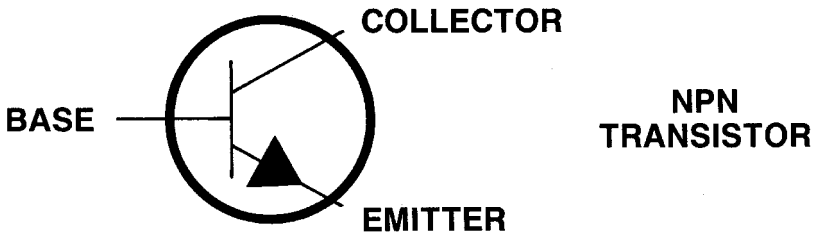
While transistors can serve in may different electronic applications, they are commonly used for low-voltage amplifier circuits.

An oscillator is similar to an amplifier circuit with some of the output fed back into the input to cause an oscillation at a certain frequency.

Triode vacuum tubes operate commonly as high



Pointing IN
Pointer



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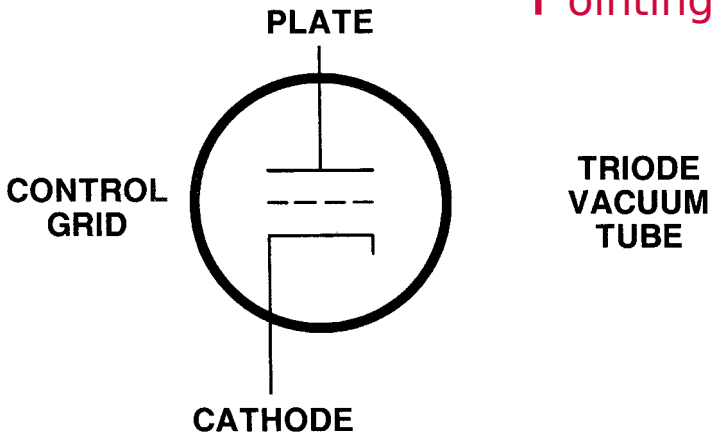

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Schematics...*Low Pass Filter*

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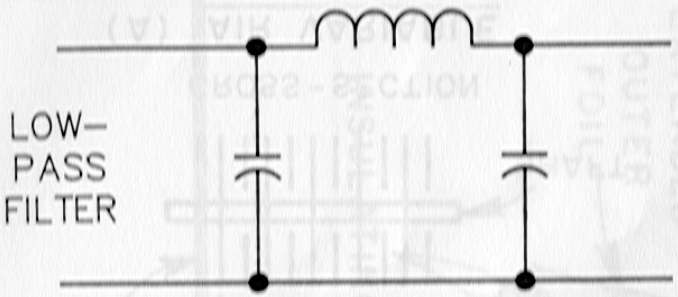
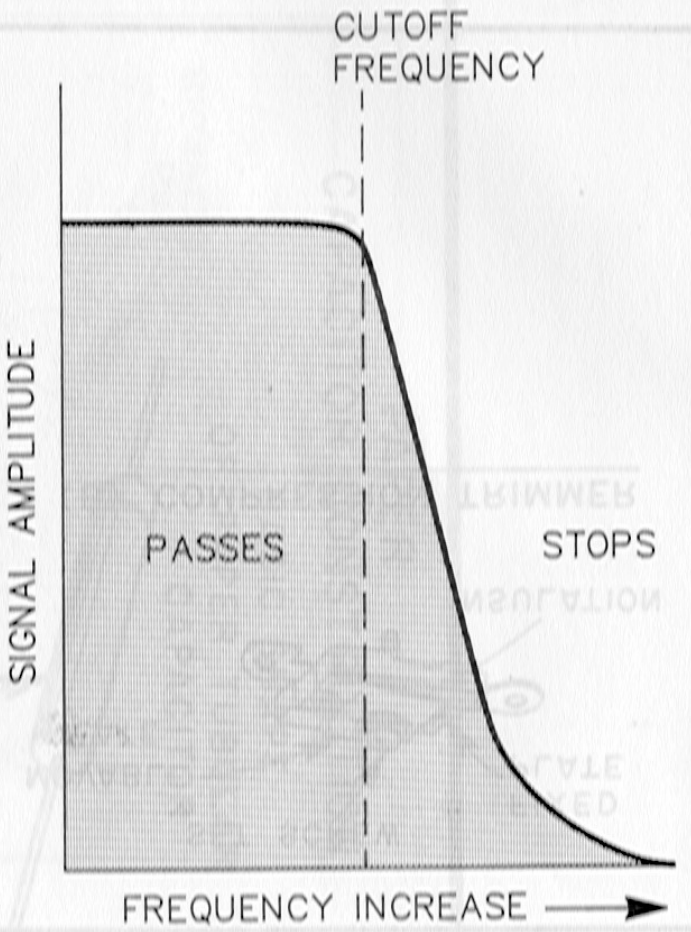


A Low Pass filter is used in the output of transmitters to eliminate harmonic radiation (Unwanted multiples of the transmitting frequency) that may cause RFI (Radio frequency Interference).



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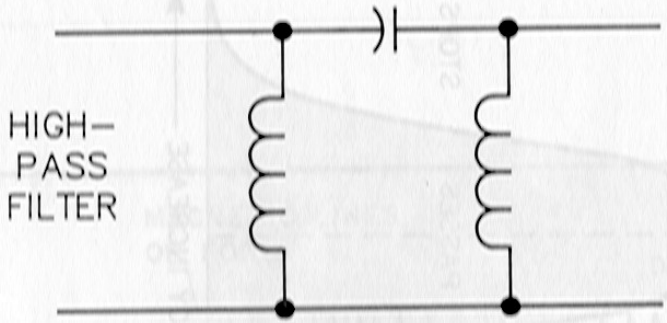
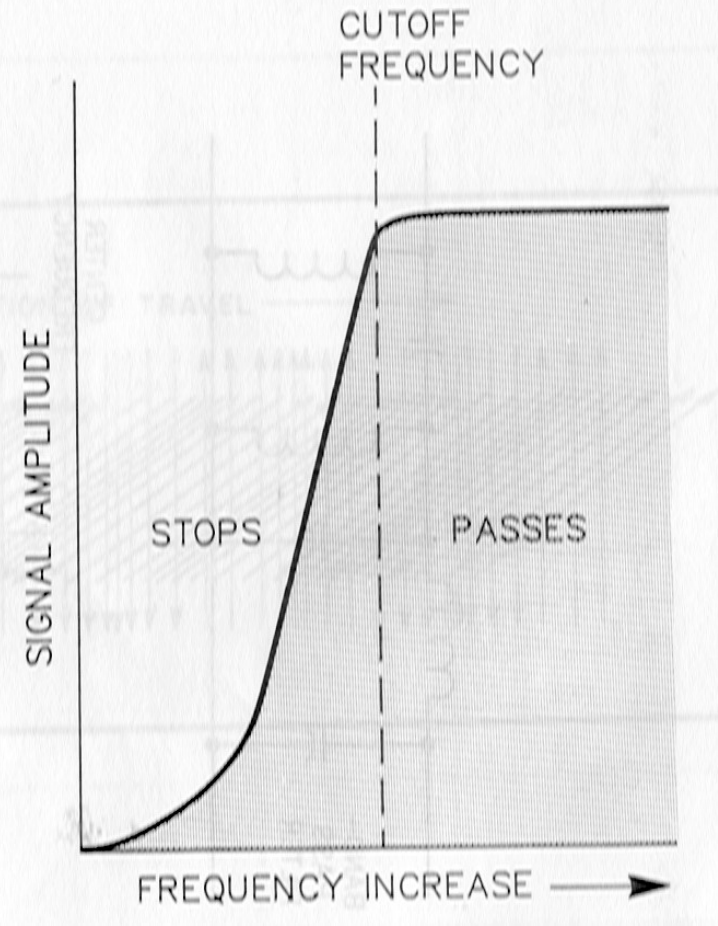
Schematics…



High Pass Filters are often used at a receiver's "front-end" to help eliminate interference caused from receiver overload of a transmitter on a lower frequency. A good example would be TVI (Television Interference). A typical Amateur station producing TVI is operating below 30 MHz. A High Pass Filter placed at the antenna input of the TV, and set for 54



NOTE: The radio operator is always responsible for correcting TVI caused by harmonic radiation. Overload is the

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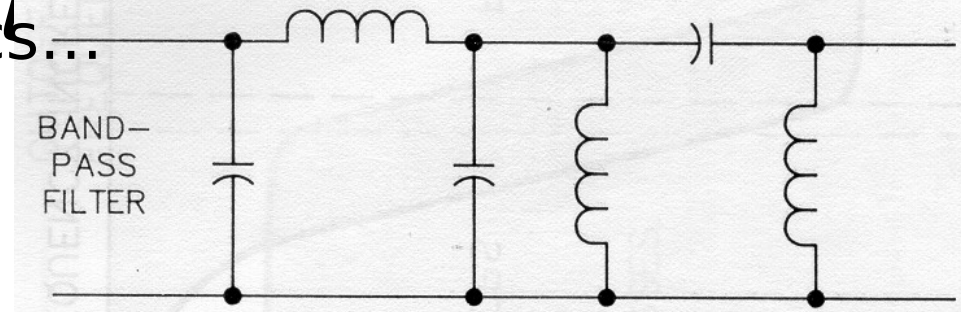
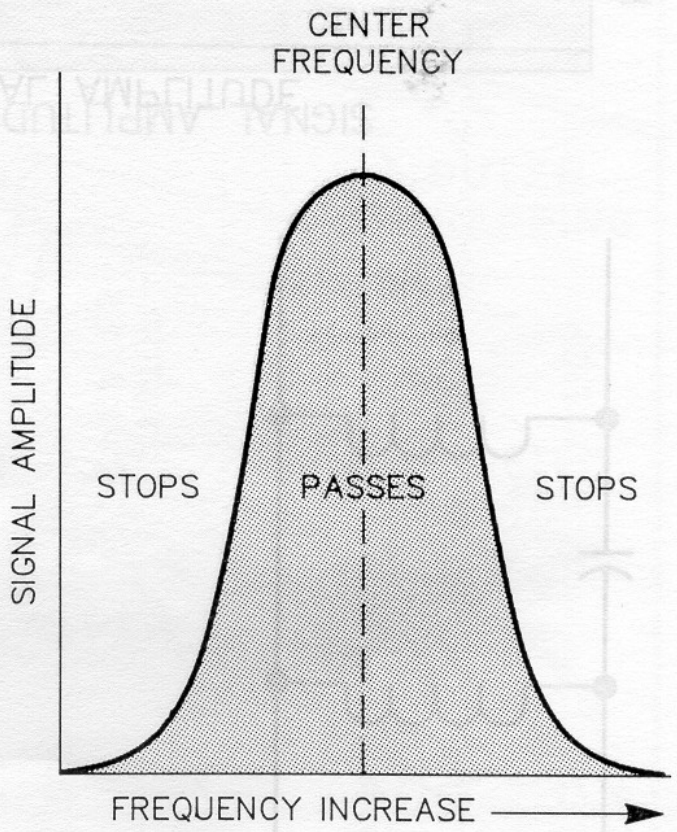


Band Pass Filters are a combi-nation of both Low Pass and High Pass filters. The result is a sharp frequency pass curve.

Band Pass Filters are used in the IF (Intermediate Frequency) section of receivers to block energy outside a certain frequency range.



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Wiring Code

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- Residential electrical 120 volt cable contains a White (hot) a black (hot) and typically a ground wire (bare).
- Residential electrical 240 volt cable contains a black (hot), a red (hot), a white (neutral) and a ground (bare).
- On a 240 volt power supply, overload fuses would be place on the hot leads (red & black).
- A 15 amp, 120 volt household circuit uses #14 gauge wire.
- A 20 amp, 120 volt household circuit uses #12 gauge wire.
- The maximum allowable circuit breaker to be used on a #12 gauge, 120 volt, household circuit is 20 Amps.
- The maximum allowable circuit breaker to be used on a #14 gauge, 120 volt household circuit is 15 Amps.

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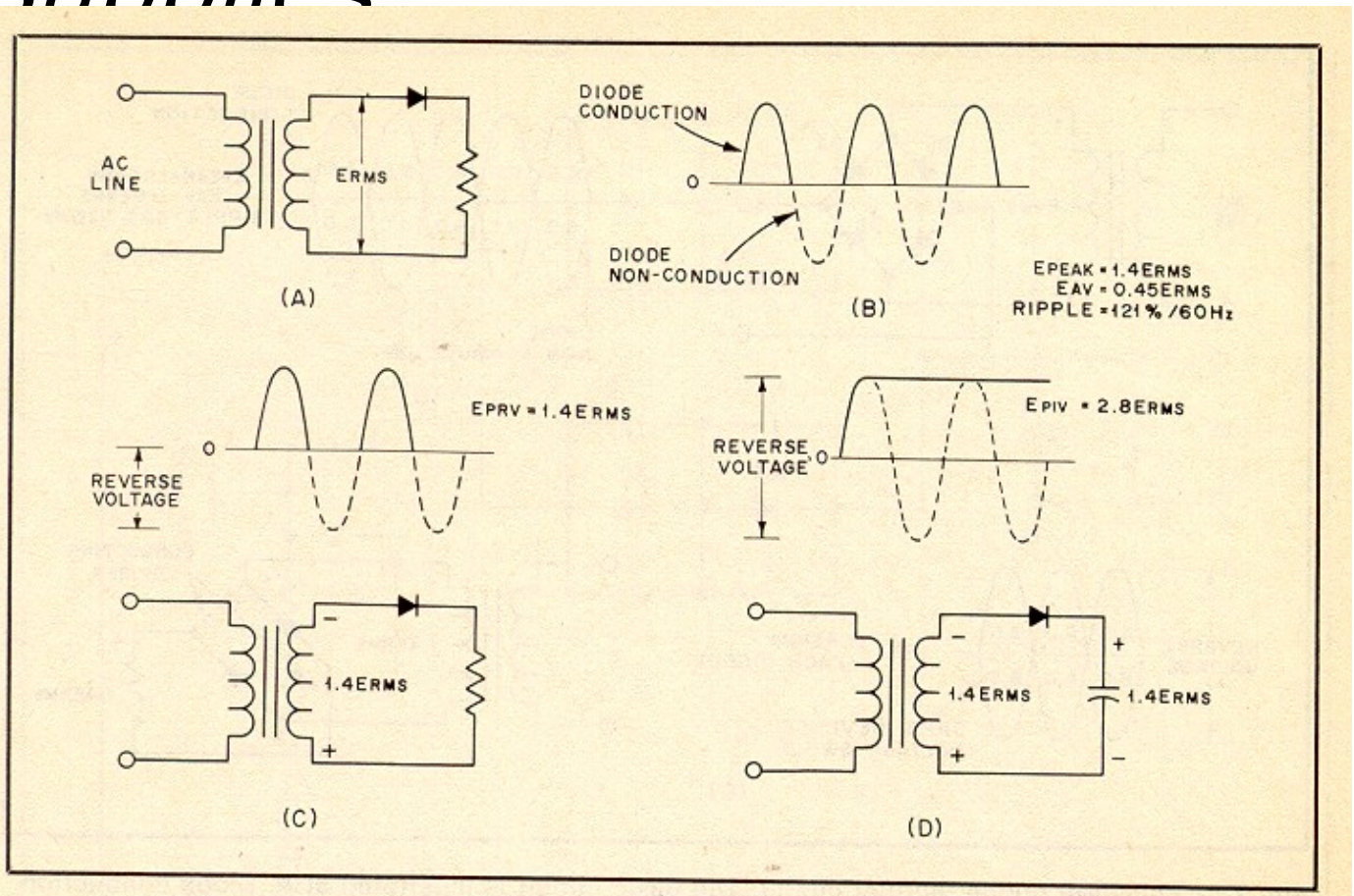

Fig. 5 — Half-wave rectifier circuit. A illustrates the basic circuit, and B displays the diode conduction and nonconduction periods. The peak-inverse voltage impressed across the diode is shown at C and D with a simple resistor load at C and a capacitor load at D. E_{PIV} is 1.4 E_{RMS} for the resistor load and 2.8 E_{RMS} for the capacitor load.

Note: the transformer winding ratio, the purpose of a diode, half-wave and full-wave rectification, capacitive & inductive filtering, bleed resistors.

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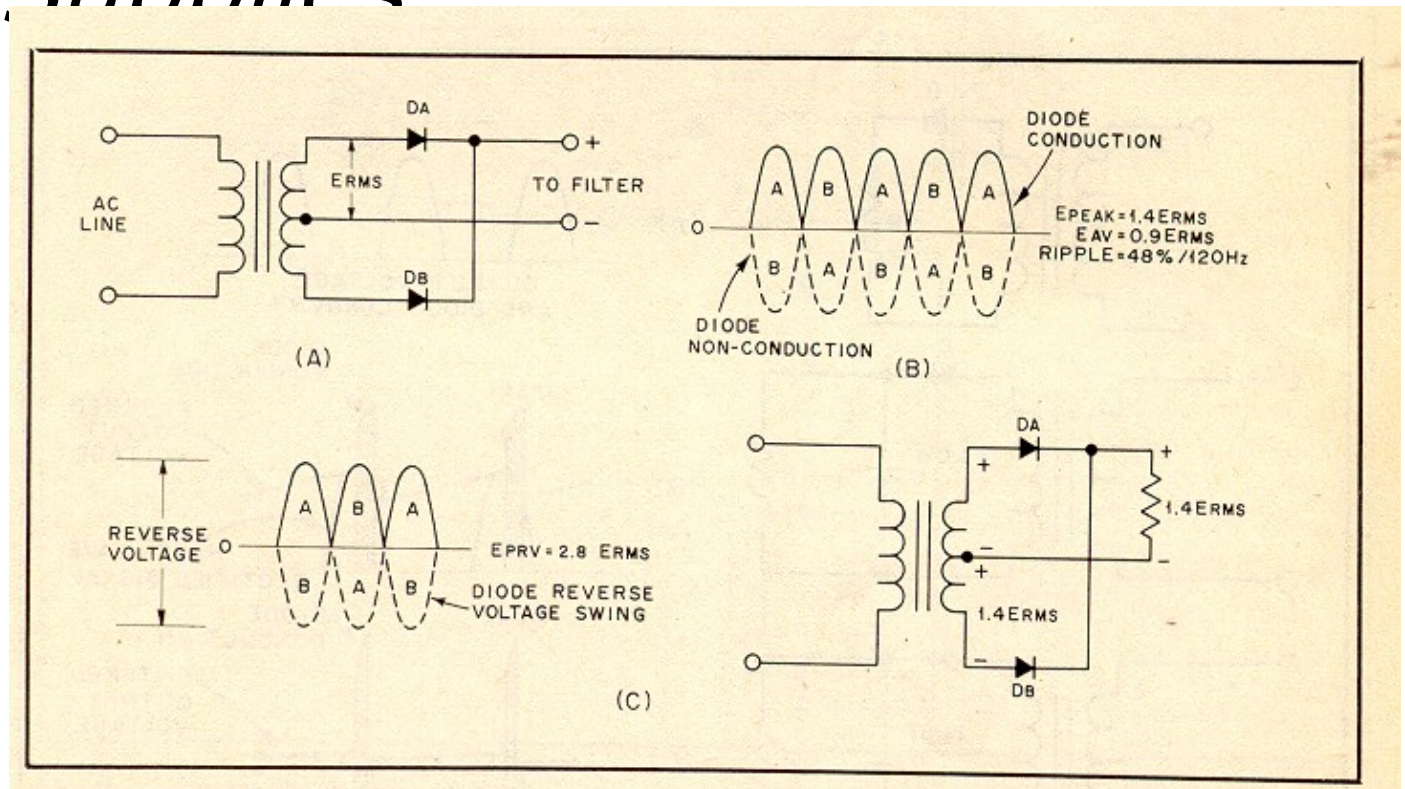

Fig. 6 — Full-wave center-tap rectifier circuit. A illustrates the basic circuit. Diode conduction is shown at B with diodes A and B alternately conducting. The peak-inverse voltage for each diode is 2.8 E_{RMS} as depicted at C.

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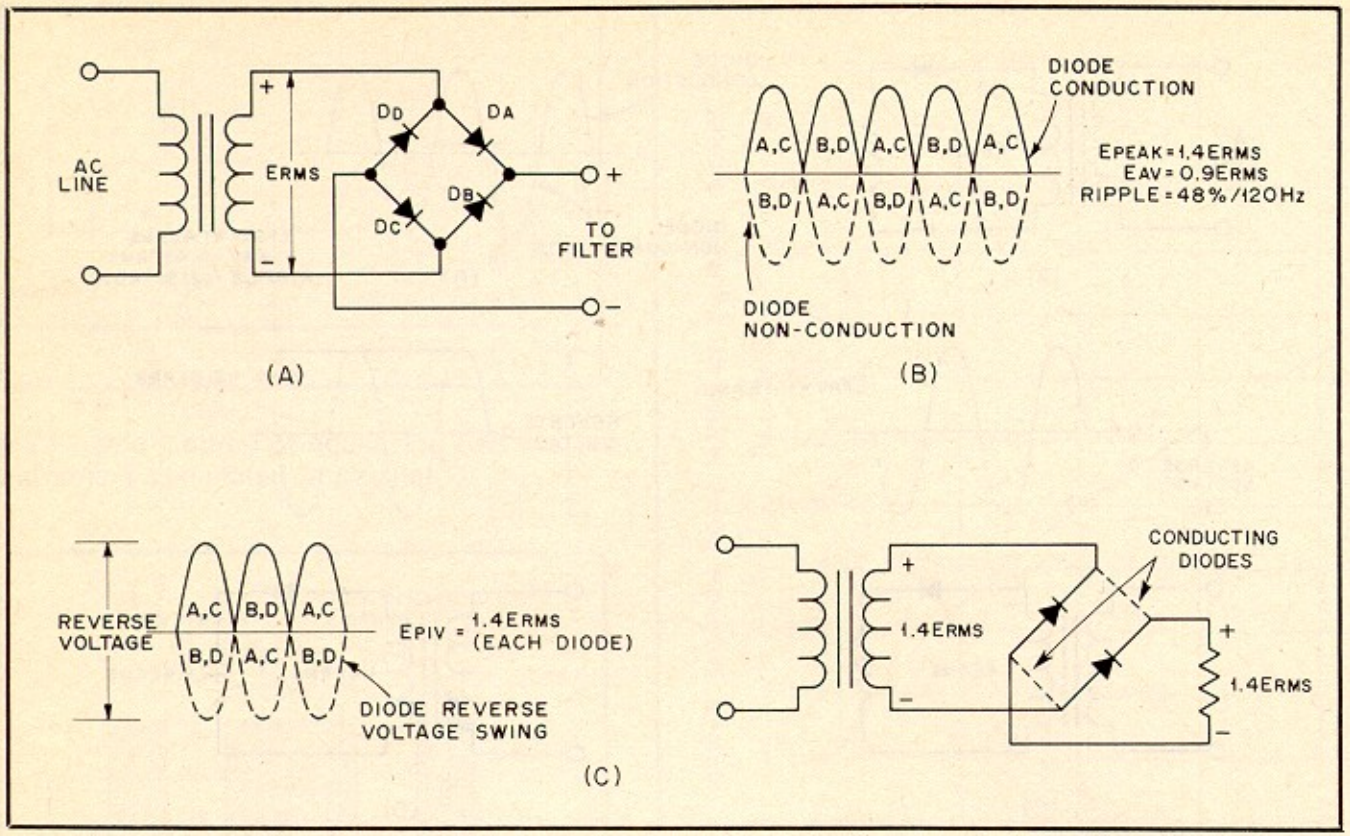

Fig. 7 — Full-wave bridge rectifier circuit. The basic circuit is illustrated at A. Diode conduction and nonconduction times are shown at B. Diodes A and C conduct on one half of the input cycle while diodes B and D conduct on the other. C displays the peak inverse voltage for one-half cycle. Since this circuit reverse-biases two diodes essentially in parallel, 1.4 E_{RMS} is applied across each diode.

*Inverse voltage rating of the diodes ought to be double of the output voltage of the power supply.

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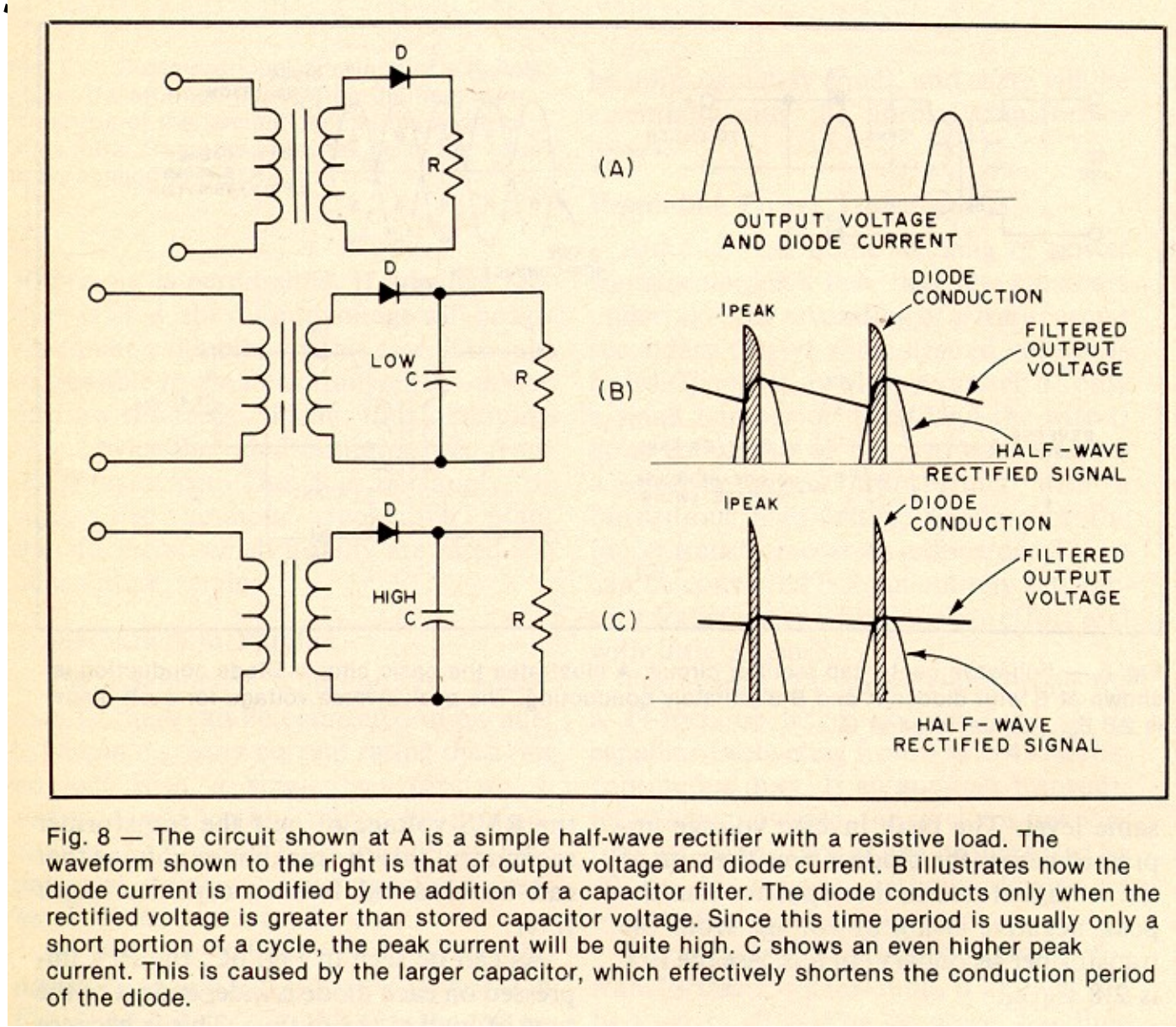

Fig. 8 — The circuit shown at A is a simple half-wave rectifier with a resistive load. The waveform shown to the right is that of output voltage and diode current. B illustrates how the diode current is modified by the addition of a capacitor filter. The diode conducts only when the rectified voltage is greater than stored capacitor voltage. Since this time period is usually only a short portion of a cycle, the peak current will be quite high. C shows an even higher peak current. This is caused by the larger capacitor, which effectively shortens the conduction period of the diode.

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Lesson 6

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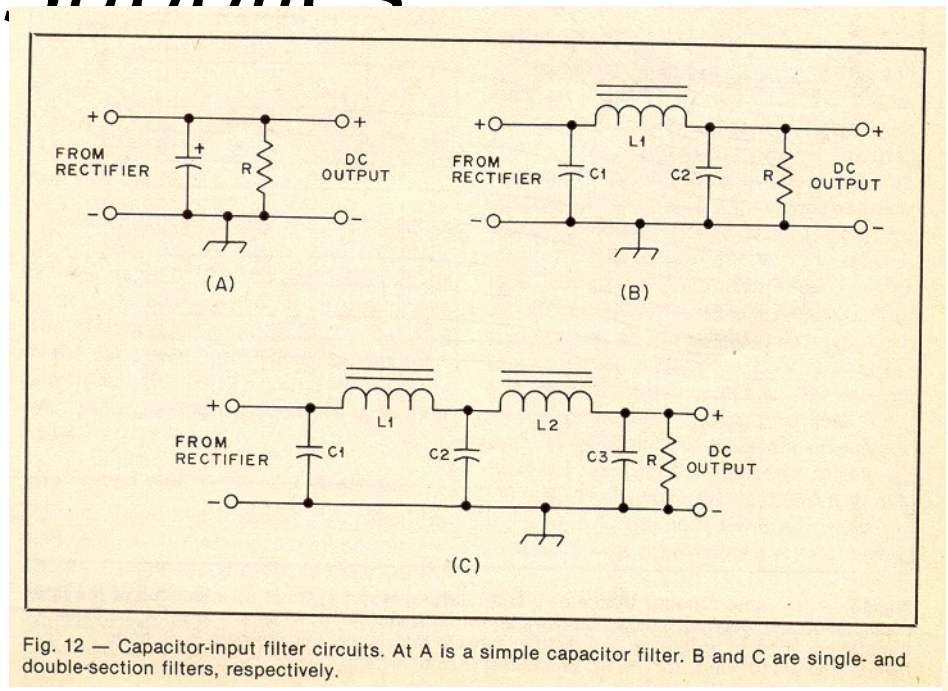

Fig. 12 — Capacitor-input filter circuits. At A is a simple capacitor filter. B and C are single- and double-section filters, respectively.

- Capacitors in power supplies are always electrolytic which have a (+) and (-) pole.
- The inductor is considered a “choke” and resists the flow of Ac while allowing the DC to pass.

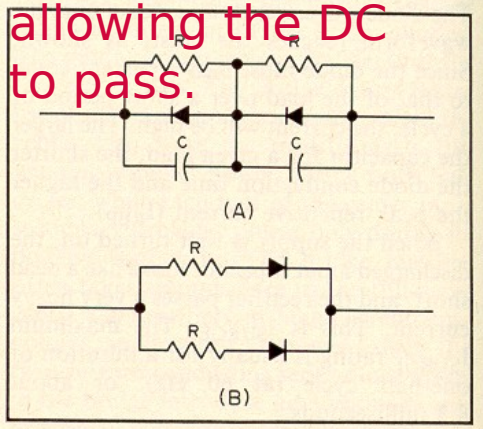

Fig. 11 — (A) Diodes connected in series should be shunted with equalizing resistors and spike-suppressing capacitors. (B) Diodes connected in parallel should have series current equalizing resistors.

- Diodes connected in series should be shunted with equalizing resistors and spike-protecting capacitors.
- Diodes connected in parallel should have series current equalizing resistors.

Basic Electronics: AC *Power Tutorial*

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The time dependence of alternating current raises questions about defining and measuring values of voltage, current and power. Because these parameters change from one instant to the next, one might wonder, for example, which point on the cycle characterizes the voltage or current for the entire cycle. A pure sine-wave reflects a total vertical displacement of "Peak-to-Peak" voltage.

When an AC voltage is applied to a resistor, the resistor will dissipate energy in the form of heat, just as iff the voltage were DC. The DC voltage that would cause identical heatin istor is the "root-mean-square" oltage. Calculate the RMS voltag e by…

$$V_{peak} = V_{RMS} \times \sqrt{2} \approx V_{RMS} \times 1.414$$

and

$$V_{RMS} = \frac{V_{peak}}{\sqrt{2}} \approx V_{peak} \times 0.707$$

AC voltage is always expressed in terms of its RMS value (i.e., 117 volts RMS in your household outlet).

An electro-dyna s a meter movement responds to the Average household voltage is 105. alculated by…

$$V_{avg} = V_{peak} \times 0.636 = V_{RMS} \times 0.899$$

and

$$V_{peak} = \frac{V_{avg}}{0.636} = V_{avg} \times 1.572$$

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RMS voltage x RMS current = average power. The average power used to heat a resistor is equal to the DC power required to produce the same heat. Peak voltage x peak current = 2 x average power.

In the context of radio signals where a sine wave is being modulated by a voice, peak power means maximum average power. "Peak Envelope Power" (PEP) is the parameter most often used to express the maximum signal-handling capability of a linear power amplifier. To compute the PEP of a waveform, multiply the PEV by .707 to obtain the RMS value, square the

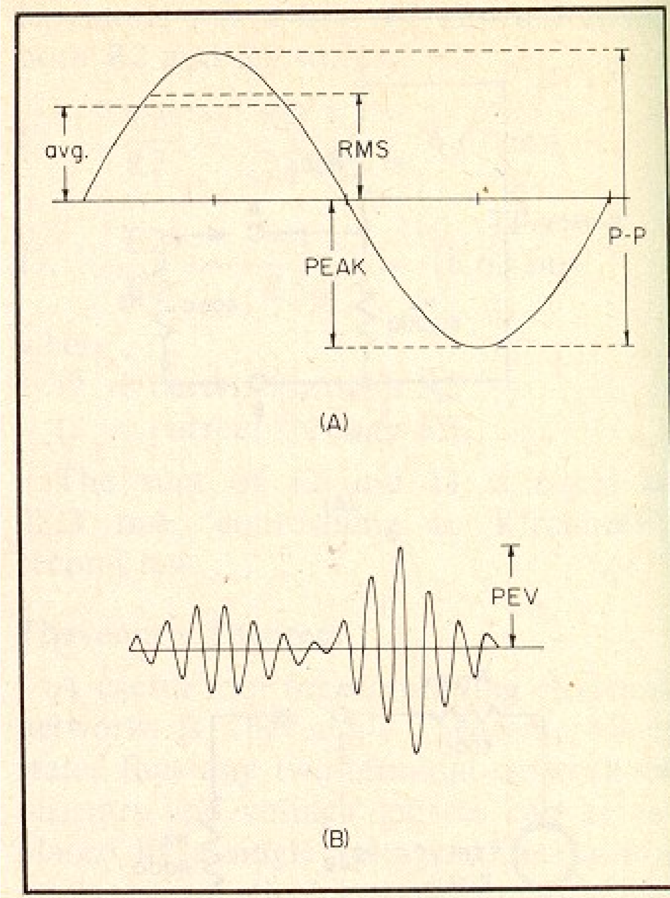

Fig. 21 — Ac voltage and current measurements. The sine-wave parameters are illustrated at A, while B shows the peak envelope voltage (PEV) for a composite waveform.

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End of Lesson 6